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Psilocybe s.s. in Thailand: four new species and a review of previously recorded species

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Abstract — *Psilocybe deconicoides*, *P. cubensis*, *P. magnispora*, *P. samuiensis,* and *P. thailandensis* (previously known from Thailand) are revisited, and *P. thaiaerugineomaculans*, *P. thaicordispora*, *P. thaiduplicatocystidiata,* and *P. thaizapoteca* are described as new species. These new species are bluing and belong to sections *Cordisporae*, *Stuntzae,* and *Zapotecorum.* Following the recent conservation of *Psilocybe* as the generic name for bluing species, *P. deconicoides,* which does not blue upon bruising, is transferred to *Deconica,* while the bluing taxa *P. cubensis* (sect. *Cubensae*), *P. magnispora* and *P. thailandensis* (sect. *Neocaledonicae*), and *P. samuiensis* (sect. *Mexicanae*) remain in *Psilocybe*.

Key words — hallucinogenic mushrooms, richness mycobiota, *Strophariaceae*, tropics

Introduction

The hallucinogenic fungal species in Thailand, as in most tropical countries, are poorly known, which is in direct contrast with the large fungal diversity that occurs throughout the tropics. Moreover, with considerable destruction of tropical habitats for use as agricultural or cattle farms, many species will likely disappear before being documented. We have been surveying several mushroom genera in northern Thailand (e.g. Le et al. 2007, Sanmee et al. 2008, Wannathes et al. 2009, Zhao et al. 2010, Karunarathna et al. 2011); but studies of *Psilocybe* are rare. Despite the recreational use of hallucinogenic mushrooms in the country (see Allen & Merlin 1992), we have found only a few references

in papers by Heim (1958, 1962), Guzmán et al. (1993), Chamratpan (2003), Klinhom et al. (2003), and Horak et al. (2009). Fortunately, Thailand now has a mycological research station, Mushroom Research Centre, where local and visiting mycologists can explore, gather and study fungi. We report *Psilocybe* spp. collected in 2010 in the area surrounding the Research Centre. We describe four species as new and discuss five species previously reported from Thailand.

Materials & methods

For microscopic study, thin hand sections of the basidiome, mainly in the pileus, including context and lamellae, were rehydrated with 96% alcohol and then mounted in 5% KOH and 1% Congo Red solutions (the latter added to tissues previously mounted in KOH). Basidiospore dimensions indicate length and width (face view) and thickness (side view). At least 25 measurements were taken for each microscopic feature. All specimens are deposited at Mae Fah Luang University herbarium (MFLU), Chiang Rai, Thailand, with duplicates in the Fungus Collection at XAL Herbarium, at Xalapa, Mexico.

Results

Five species of *Psilocybe* s.l. known from Thailand are discussed here (*P. cubensis*, *P. deconicoides*, *P. magnispora*, *P. samuiensis*, and *P. thailandensis*) and four new species are proposed.

Psilocybe cubensis (Earle) Singer, Sydowia 2: 37, 1948

≡ *Stropharia cubensis* Earle, Estudios Agronómicos, Cuba 1: 240, 1906

This is an important hallucinogenic mushroom with a pantropical distribution, although the records from Africa (Cullinan et al. 1945, Vedcourt & Trump 1969) are still under study to determine whether they represent *P. aquamarina* (Pegler) Guzmán (≡ *Stropharia aquamarina* Pegler), as discussed by Heim (1958, 1962), Pegler (1977), and Guzmán (1995). The Thai material (identified as *Stropharia cubensis*) studied by Heim, based on two collections (one by Apaiwongse, the second by Champagne) from the Bangkok region in 1957, agree well with the Mexican specimens studied by Heim. Recently Chamratpan (2003) and Klinhom et al. (2003) reported *P. cubensis* from Thailand as a "magic" and/or "soporific" mushroom. This coprophilous fungus, common on cattle and horse dung in meadows, probably grows also in Thailand on wild mammal dung. The African mentioned above was reported by Vedcourt & Trump (1969) on monkey dung, and Guzmán & Ramírez-Guillén (2010) reported the closely related *P. subcubensis* Guzmán on rhinoceros dung in Nepal. Nonetheless, Guzmán did not find *P. cubensis* nor *P. subcubensis* in meadows explored in Thailand in 2010, where he found only *Copelandia cyanescens* (Berk. & Broome) Singer and *Panaeolus* spp.

Psilocybe cubensis as shown in the key (below) has a well developed annulus, hyaline pleurocystidia, and thick walled basidiospores — (12–)13–15(–17) × 8–10(–11) × 7–9 µm — that are subhexagonal in face-view and subellipsoid in side-view (Guzmán 1983).

Deconica deconicoides (E. Horak, Guzmán & Desjardin) Guzmán, **comb. nov.**

Mycobank MB563261 Figures 1–3

≡ *Psilocybe deconicoides* E. Horak, Guzmán & Desjardin, Sydowia 61(1): 32, 2009

According to Horak et al. (2009) this is a non-bluing species, growing on rotting branches in Chiang Mai Prov. characterized by small mycenoid basidiomata with broadly adnate to decurrent lamellae. The thick-walled basidiospores — (5.5–)6–6.5 × (4.5–)5–5.5 × 3.5–4 µm — are rhomboid in face-view and ellipsoid in side-view. Basidia 17–23 × (5–)6.5–7 µm, 4-spored, hyaline, ventricose-clavate. Pleurocystidia absent. Cheilocystidia (14.5–)16–19(–24) × 5–6(–7) µm, polymorphic, ventricose, clavate, fusoid or sublageniform.

Material studied — **THAILAND. Chiang Mai Prov.**, Chiang Mai, Dui Suthep, 19 km marker, June 6, 2002, Horak 10156 (isotype XAL).

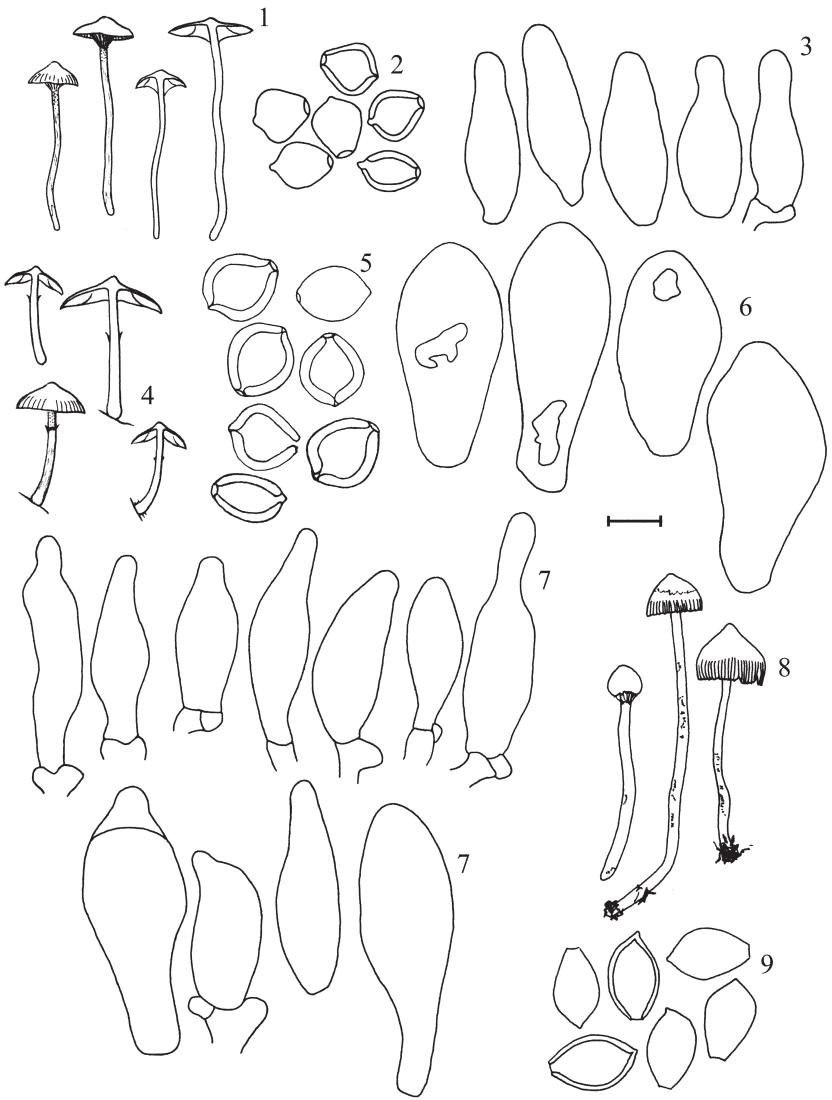
Remarks: Moncalvo et al. (2002) showed two *Psilocybe* s.l. clades, one containing the bluing species and the other containing the non-bluing species. Redhead et al. (2007) proposed to conserve the name *Psilocybe* for the bluing clade and accommodate the non-bluing clade under *Deconica*. This proposal was supported by the Nomenclature Committee for Fungi (Norvell 2010) and accepted on July 31, 2011, by the 18th International Botanical Congress, Melbourne, necessitating the transfer of *P. deconicoides* to *Deconica*.

Psilocybe magnispora E. Horak, Guzmán & Desjardin, Sydowia 61: 25, 2009

Figures 4–7

This bluing species grows on old rotting elephant dung in a tropical montane forest and is only known from Pong Chang Province at Kha Yai (Horak et al. 2009). The basidiomata have a convex to obtusely papillate pileus (20–)30–45 mm diam, adnate lamellae, and stipe 35–60 × 2.5–4(–6) mm, with a submembranous annulus. Basidiospores are 7–8(–8.5) × (5.5–)6–7 × 5–5.5 µm, thick walled, and rhomboid in face-view. Pleurocystidia 21–28(–31) × (7–)9–13 µm, more or less common, ventricose-claviform or subfusoid, sometimes submucronate, hyaline, frequently with refringent incrustations, as chrysocystidia. Cheilocystidia (13–)16–26(–30) × 5–7(–10) µm, polymorphous, fusoid, ventricose or sublageniform, hyaline. The chrysocystidia and rhomboid spores place *P. magnispora* in sect. *Neocaledonicae* Guzmán.

Material studied — **THAILAND, Kha Yai**, Pong Chang, Princess Trail, July 6, 2002, Horak 10171 (isotype XAL).



Figures 1–9. ***Deconica deconicoides*** (type) – 1. basidiomata; 2. basidiospores; 3. cheilocystidia. ***Psilocybe magnispora*** (type) – 4. basidiomata; 5. basidiospores; 6. pleurocystidia; (chrysocystidia); 7. cheilocystidia. ***P. samuiensis*** (type) – 8. basidiomata; 9. basidiospores. Scale bars: 1, 8 = 10 mm; 4 = 20 mm; 2–3, 5–7 = 5.5 µm; 9 = 10 µm.

Psilocybe samuiensis Guzmán, Bandala & J.W. Allen, Mycotaxon 46: 156, 1993

Figures 8–11

This species, known only from Thailand, grows on rich soil in meadows (Guzmán et al. 1993). It presents basidiomata like *P. mexicana* R. Heim, with pileus 7–15 mm diam., lamellae adnexed and stipe 40–65 × 1.5–2 mm, without annulus. Basidiospores 10–13 × 6–8 µm, rhomboid to subrhomboid in face-view, thick-walled. Pleurocystidia 16–20 × 5–6.5 µm, scattered, sublageniform, hyaline and cheilocystidia 18–28(–30) × (5–)5.5–7(–8) µm, sublageniform, sometimes branched.

Basidiospore morphology supports *P. samuiensis* within sect. *Mexicanae* Guzmán. Molecular analyses by Borovička et al. (2011) that show this species as separate from sects. *Cyanescens* and *Semilanceatae* support sect. *Mexicanae* as independent.

Material studied — **THAILAND, Surat Thani Prov.**, Koh Samui, Thailand, 2 km west of Ban Hua Thanon, August 8, 1991, Allen s.n. (holotype XAL).

Psilocybe thailandensis E. Horak, Guzmán & Desjardin, Sydowia 61: 30, 2009

Figures 12–15

This bluing species grows on rotten wood in a tropical montane forest (Horak et al. 2009). Pileus (4–)6–15 mm, conic, brown to pale brown, turning paler after drying, with veil remnants at the margin. Lamellae adnate. Stipe (10–)15–30 × 1–2 mm, subbulbous, with a fibrillose-membranaceous annulus, sometimes ephemeral. Basidiospores (4.5–)5–6(–6.5) × 4.5–5.5 × 3–4 µm, rhomboid in face-view, ellipsoid in side-view, thick–walled. Pleurocystidia of the chrysocystidia type with a refringent content, common, 16–25(–30) × (6.5–)7–9(–10), broadly clavate or vesiculose. Cheilocystidia (11–)20–30 × 3.5–6 µm, hyaline, sublageniform, ventricose-rostrate or irregularly slender subfusoid. Its chrysocystidia and rhomboid thick-walled spores place *P. thailandensis* in sect. *Neocaledonicae* with *P. magnispora*.

Material studied — **THAILAND, Chiang Mai Prov.,** Doi Suthep, Monthatharn Waterfall Trail, July 4, 2002, Horak 10128 (isotype XAL); trail to Huai Kok, Horak 10115 (paratype XAL).

Psilocybe thaiaerugineomaculans Guzmán, Karunarathna & Ram.-Guill., **sp. nov.**

MycoBank MB 561575 Figures 30–35

Differs from *Psilocybe aerugineomaculans* in producing pyriform yellowish brown pseudocystidia from the hymenophoral trama.

Type: Thailand, Chiang Mai Prov., Chiang Mai University Park, 18°48′N 98°53′E, elevation 300 m, July 27 2010, Karunarathna NTS-121 (**holotype** MFLU-10-0851; **isotype** XAL.

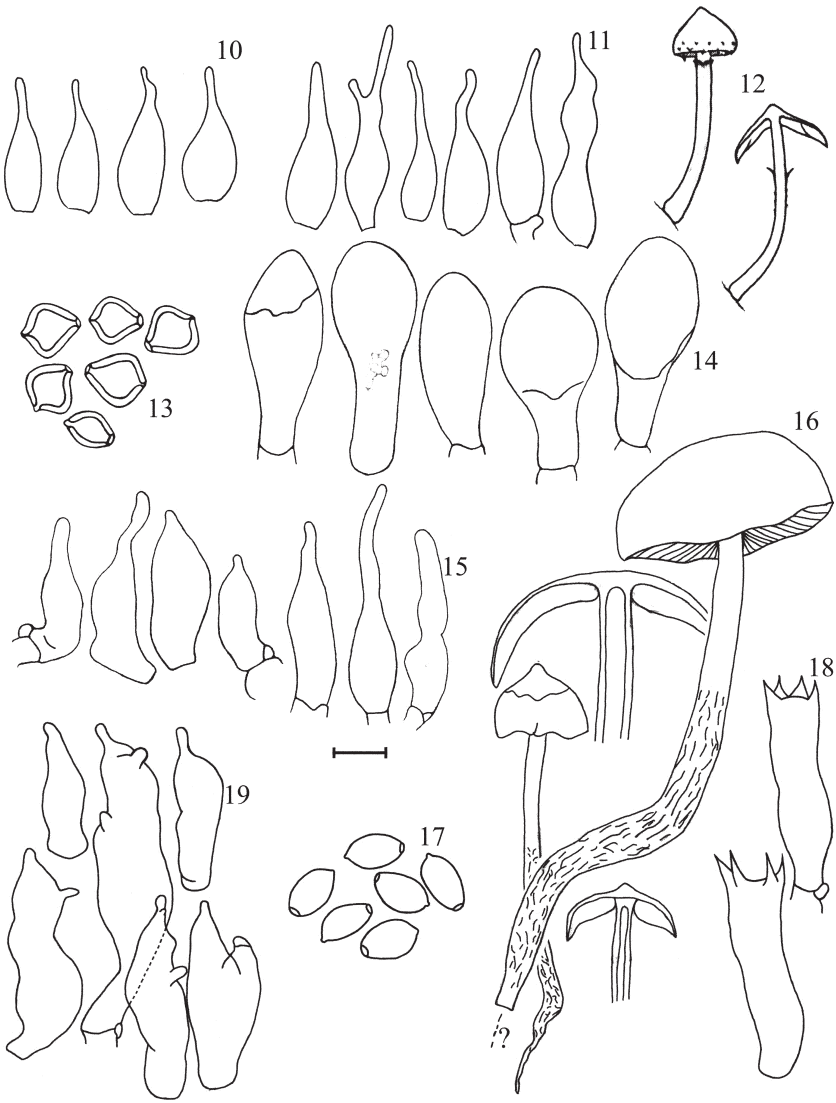
Etymology: The epithet refers to Thailand and to the similar species *P. aerugineomaculans*.

Pileus 10–20 mm diam., conic to subumbonate, finally convex, smooth, glabrous, margin glabrous, striate when dry, hygrophanous, dark reddish brown to pale yellowish brown to whitish, bluing, finally blackish chocolate when dry. Lamellae broadly adnate to subadnexed, brownish violaceous to chocolate-brown, with white edges. Stipe 25–45 × (2–)3–4 mm, equal, subbulbous, smooth above, sub-floccose below, base fibrillose, pale yellowish brown to white or brownish black to reddish brown, hollow to stuffed, with whitish conspicuous mycelium at the base. Annulus membranous, white to off white, thick, persistent. Context white to pale rose, bluing upon exposure. Odor & taste not checked, in herbarium specimens none, but taste strongly pungent after some minutes. Spore print unknown.

Basidiospores 9–12 × 7–8(–9) × 5.5–7 µm, subrhomboid or subhexagonal in face-view, subellipsoid in side-view, thick-walled, wall 1–1.5 µ thick, yellowish brown, with a slightly truncate germ pore at the apex and a short, acute apiculus at the base. Basidia 21–31(–36) × (6–)7–10 µm, 4-spored, hyaline, cylindric-vesiculose to subclaviform, the sterigmata up to 6 µm long. Pleurocystidia (11–)14–22(–24) × 5–11(–13) µm, hyaline, thin-walled, more or less common, ventricose-mucronate to sub-rostrate or fusiform-globose or obovate. Pseudocystidia (25–)26–33(–35) × 11–16 µm, pyriform, content oily, yellowish brown, growing from the hymenophoral trama. Cheilocystidia 15–20 × (5–)6–8(–10) µm, hyaline, ventricose-mucronate to sub-rostrate or sublageniform, some fusiform or sub-ovate, rarely irregularly branched. Subhymenium subcellular, hyaline to yellowish pale, the elements 2–9 µm wide, thick-walled. hymenophoral trama regular, with hyphae 2–23 µm wide, hyaline, rarely pale yellowish, thin- to thick-walled. Pileipellis an ixocutis, 21–30 µm thick, with hyaline hyphae, 2–6 µm wide. Context with hyaline or some yellowish hyphae, 2–12 µm wide. Clamp connections present.

Habit, habitat and distribution — Solitary or gregarious at 300 m on soil with rotting cow dung, in an open grassland below the shadow of trees. Known only from the type locality.

Discussion. Possession of a stipe annulus on the stipe and thick-walled subrhomboid spores place *P. thaiaerugineomaculans* in sect. *Stuntzae* Guzmán. The pseudocystidia easily separate this species from all others in the section, mainly with the similar *P. aerugineomaculans* (Höhn.) Singer & A.H. Sm. from Java. That species, which has an ixocutis ≤ 10 µm thick and basidiospores 8.5–10.5 × 7–8 × 5.5–6.5 µm, lacks pseudocystidia and its cheilocystidia are 18–22 × 6–8 µm (Singer & Smith 1958). Another similar species, also from Java, is *P. subaeruginascens* Höhn., grows on dung, has 25–33 × 9–12 µm pleurocystidia and 20–33 × 6–9 µm cheilocystidia, lacks pseudocystidia, and its pileipellis is not gelatinous (Singer & Smith 1958). Guzmán (1983) referred



Figures 10–19. ***Psilocybe samuiensis*** (type) – 10. pleurocystidia; 11. cheilocystidia. ***P. thailandensis*** (type) – 12. basidiomata; 13. basidiospores; 14. pleurocystidia (chrysocystidia); 15. cheilocystidia. ***P. thaizapoteca*** (type) – 16. basidiomata; 17. basidiospores; 18. basidia; 19. pleurocystidia. Scale bars: 12, 16 = 10 mm; 10–11 = 8 μm; 13–15, 17–19 = 5.5 μm.

both Höhnel species to *P. subaeruginascens* but later (Guzmán 1995) separated them following Singer & Smith (1958). Recently Guzmán & Yang (2010) described *P. taiwanensis* Zhu L. Yang & Guzmán from Taiwan, also in the sect. *Stuntzae*, with conic to subumbonate pilei, (5.5–)6–7 × (3.5–)4–4.5 × 3.5–4 µm basidiospores, pileipellis with 8–10 × 4–5.5 µm cystidioid elements, and lacking pseudocystidia. We conclude that *P. thaiaerugineomaculans* is a well-defined Asiatic species independent from *P. aerugineomaculans*, *P. subaeruginascens,* and *P. taiwanensis*. A final note: Guzmán would refer the unidentified annulate *Psilocybe* from northern Thailand depicted in Stamets (1996: 171, 4th picture at bottom of color plate) to *P. thaiaerugineomaculans* based on form and color of the basidiomata, which agree well with the species here described.

Psilocybe thaicordispora Guzmán, Ram.-Guill. & Karunarathna, **sp. nov.**

MycoBank MB 561576 Figures 21–29

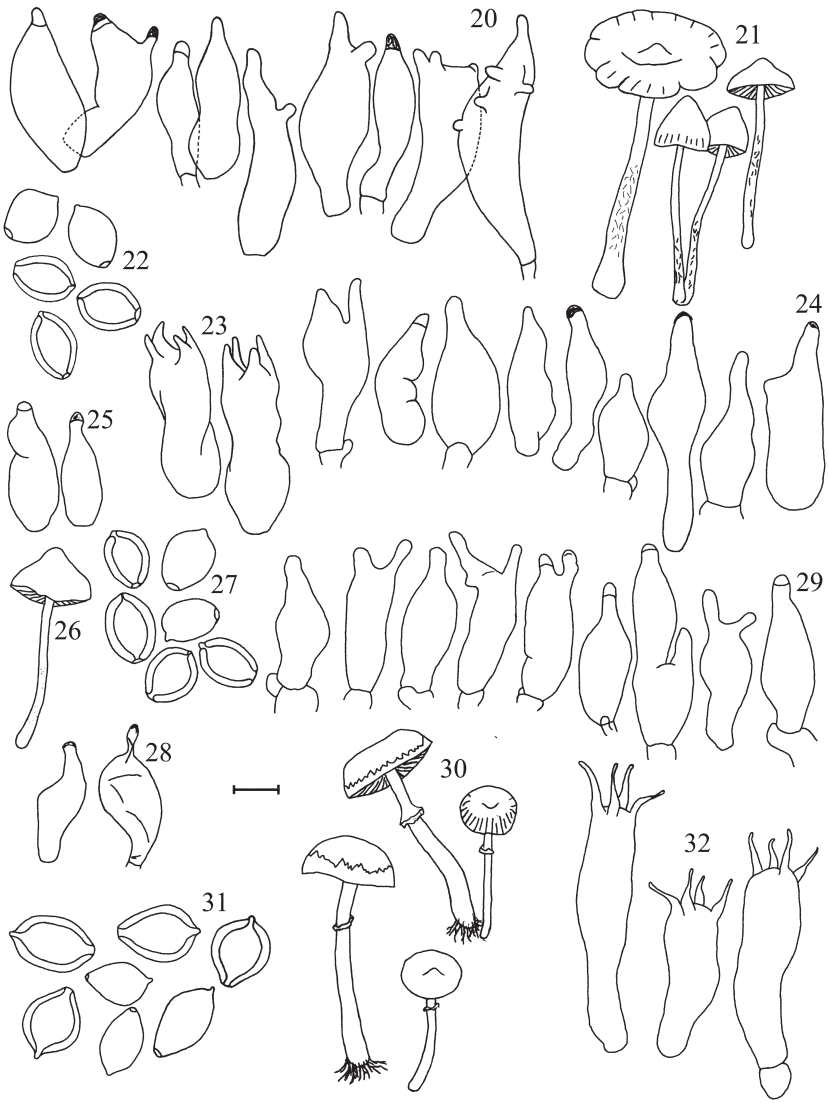
Differs from *Psilocybe thaicordispora* in narrower longer branched cheilocystidia and presence of pleurocystidia.

Type: Thailand, Chiang Mai Prov., approximately 100 km from Chiang Mai, near Huai Nam Dang National Park, (19°16′N 98°16′E), elevation 1500 m, rainforest dominated by *Pinus kesiya*, July 12, 2010; Guzmán 38349 (**holotype** MFLU-10-0804, **isotype** XAL).

Etymology: The epithet refers to Thailand and to the sect. *Cordisporae*.

Pileus 10–30 mm diam., conic to subcampanulate, finally convex or subconcave-umbonate, sometimes irregularly lobulate, sub-hygrophanous, yellowish brown to brownish orange, smooth, glabrous, without veil remnants, cuticle not separable. Lamellae subadnexed, yellowish pale to dark brown-violaceous, with whitish edges. Stipe 35–50 × 1–4 mm, uniform or subbulbous, smooth above to subfloccose toward the base or the latter is smooth, whitish above to reddish brown or reddish black. Veil poor development. Context white and thick below pileus, yellowish and fibrous in stipe. The entire basidiome intensely bluing and becoming blackish. Dried specimens are black-chocolate. Odor and taste slightly farinaceous. Spore print unknown.

Basidiospores (6.5–)7–8(–9) × (4.5–)5–5.5(–6.5) × 4.5–5 µm, subrhomboid or ovoid in face-view, subellipsoid in side-view, thick-walled, wall 1–1.5 µm thick, yellowish brown, with a truncate germ pore at the apex and a short acute apiculus at the base. Basidia 20–25 × 6–7 µm, 4-spored, hyaline, ventricose-subcylindric or subclaviform, with a middle constriction. Pleurocystidia 12–18(–24) × 3.5–7 µm, rare or more or less common, hyaline, thin-walled, ventricose, mucronate to rostrate. Cheilocystidia 12–20(–28) × (4.5–)5–7 (–8) µm, hyaline, thin-walled, polymorphous, ventricose, mucronate or rostrate, sometimes with a long cylindric base, apex frequently and irregularly bifurcate or branched. Subhymenium subcellular, with hyaline elements to incrusted by yellowish brown pigment, also with blue-green pigment. hymenophoral



Figures 20–32. ***Psilocybe thaizapoteca*** (type) – 20. cheilocystidia. ***P. thaicordispora*** (21–25 = type; 26–29 = Guzmán 38346) – 21. basidiomata; 22. basidiospores; 23. basidia; 24. cheilocystidia; 25. pleurocystidia; 26. basidiomata; 27. basidiospores; 28. pleurocystidia; 29. cheilocystidia. ***P. thaiaerugineomaculans*** (type) – 30. basidiomata; 31. basidiospores; 32. basidia. Scale bars: 21, 26, 30 = 10 mm; 20, 22–25, 27–29, 31–32 = 5.5 µm.

Trama regular, with hyphae (2–)3–20(–25) µm wide, thin- or thick-walled, up to 0.8 µm thick, branched, hyaline. Pileipellis an ixocutis, 12–20 µm thick, with hyphae, 2–5 µm wide, hyaline, branched. Context subcellular, hyaline to pale brownish through the pileipellis, with hyphae 3–9(–23) µm wide, hyaline, some branched. Clamp connections present.

Habit, habitat and distribution — Solitary or gregarious, on grassy soil, below the shadow of trees, in an open subtropical forest, at 1500 m elevation. Known only from the type locality.

Additional material studied — **THAILAND**, **Chiang Mai Prov.**, approximately 100 km from Chiang Mai, near Huai Nam Dang National Park, (19°16′N 98°16′E), elevation 1500 m, rainforest dominated by *Pinus kesiya*, July 12, 2010; Guzmán 38346 (MFLU-10-0801; XAL).

Discussion. *Psilocybe thaicordispora* belongs to sect. *Cordisporae* Guzmán because of its small spores, which are ovoid or subrhomboid in face-view, thick-walled and have a broad germ pore, as well as in its tropical habitat. It is somewhat similar to *P. papuana* Guzmán & E. Horak known only from Papua New Guinea, and also has polymorphous cheilocystidia, but these are wider, shorter and un-branched, (6.5–)10–18 × 6.5–13 µm, and apparently has no pleurocystidia (Guzmán & Horak 1978). Another similar species is *P. dumontii* Singer ex Guzmán known only from Panama, but this species has un-branched cheilocystidia which are not so variable in form, 10–18(–26) × 3–6(–8) µm, hyaline to somewhat brownish (Guzmán 1978, Guzmán & Piepenbring 2011).

Psilocybe thaiduplicatocystidiata Guzmán, Karunarathna & Ram.-Guill., **sp. nov.**

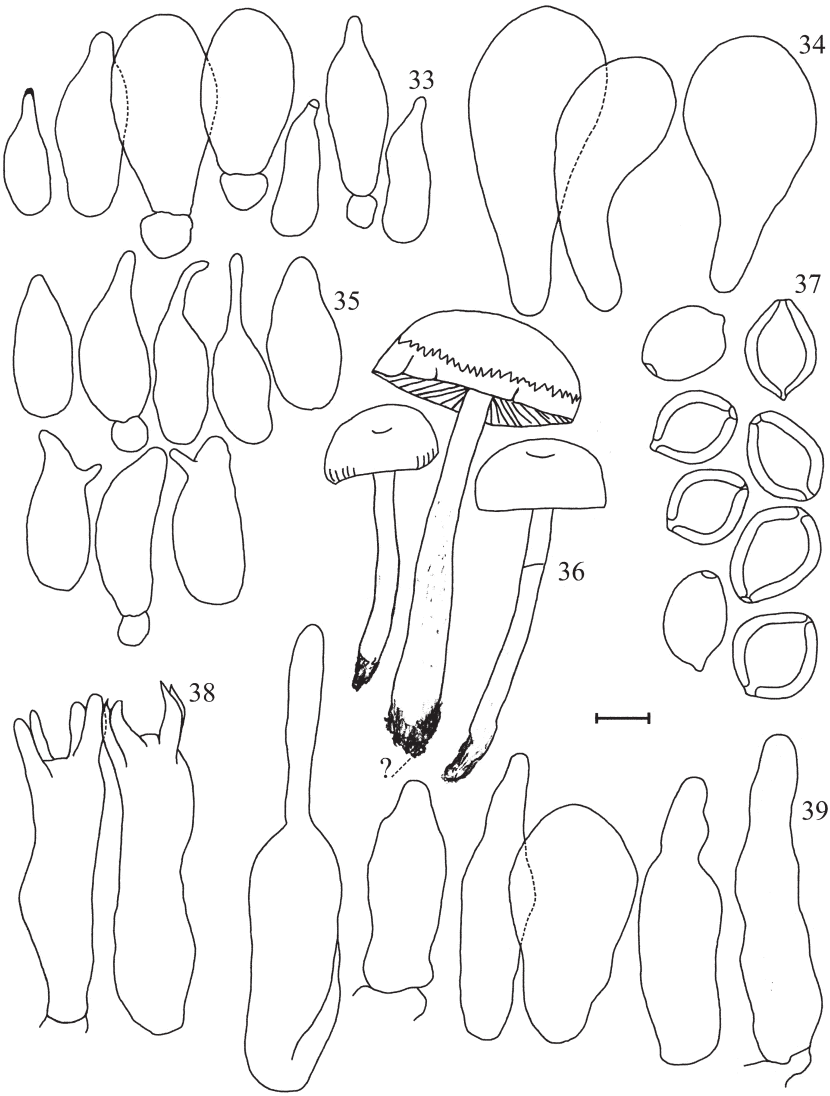
MycoBank MB 561577 Figures 36–42

Differs from *Psilocybe caerulescens* in the possession of pleurocystidia, polymorphic cheilocystidia, and longer basidiospores.

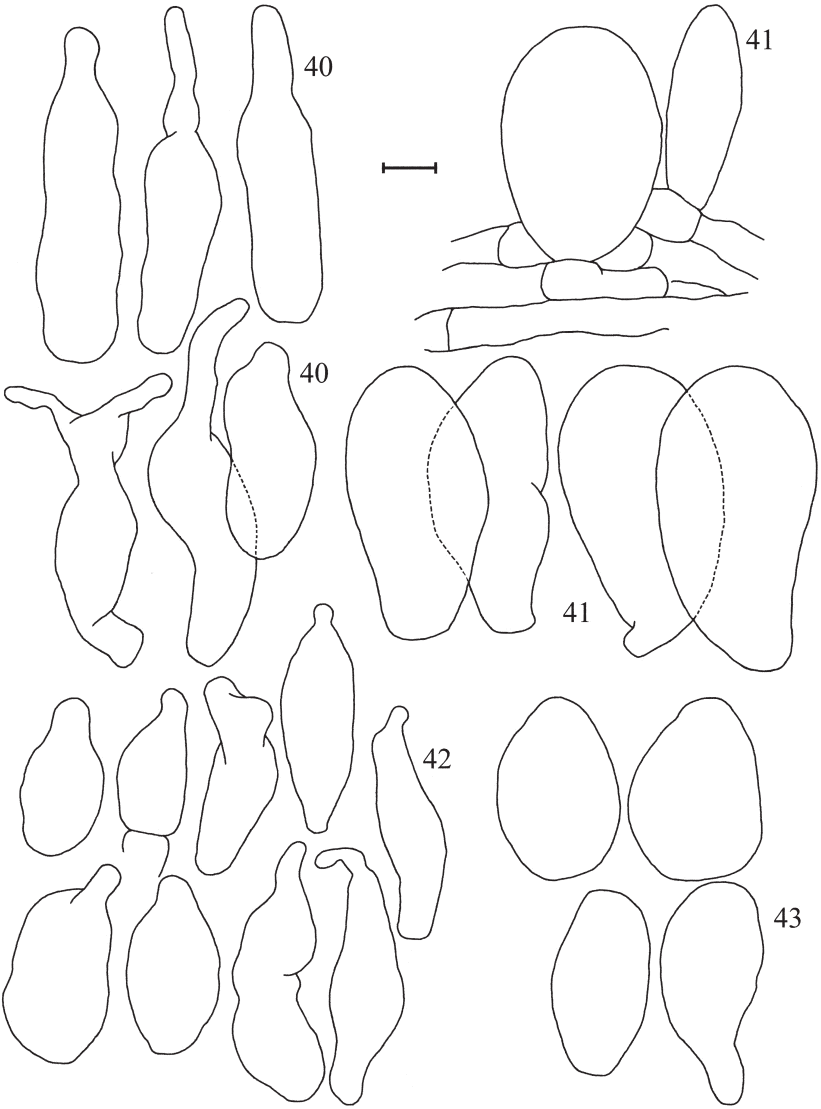
Type: Thailand, Chiang Mai Prov., Chiang Mai University Park, 18°48′N 98°53′E, elevation 300 m, July 27, 2010, SC Karunarathna NTS-120 (**holotype** MFLU-10-0850, **isotype** XAL).

Etymology: The epithet refers to Thailand and the dimorphic pleurocystidia and cheilocystidia.

Pileus 20–40 mm diam., convex to subumbonate or subumbilicate, glabrous, smooth but margin slightly striate, also sometimes sub-lobulate, sub-hygrophanous, pale brown or brownish rose to brownish dull orange at the center, pale yellowish brown when dry, bluing to becoming irregularly blackish chocolate. Lamellae adnate to seceding, black-violaceous to blackish chocolate, with white edges. Stipe 45–75 × 4–6 mm, equal, subbulbous, probably with a pseudorhiza (not gathered), surface white to pale to dark reddish brown, or pale grayish brown when dry, smooth above to sub-floccose below, hollow to stuffed. Context white to pale rose, bluing. Odor and taste not checked



Figures 33–39. ***Psilocybe thaiaerugineomaculans*** (type) – 33. pleurocystidia type A; 34. pleurocystidia type B; 35. cheilocystidia. ***P. thaiduplicatocystidiata*** (type) – 36. basidiomata; 37. basidiospores; 38. basidia; 39. pleurocystidia type A. Scale bars: 36 = 10 mm; 33–35, 37–39 = 5.5 µm.



Figures 40–43. ***Psilocybe thaiduplicatocystidiata*** (type) – 40. pleurocystidia type A; 41. pleurocystidia type B; 42. cheilocystidia type A; 43. cheilocystidia type B. Scale bar = 5.5 µm.

when fresh, without any odor or taste in herbarium specimens, but the taste after some minutes is strongly pungent. Spore print unknown.

Basidiospores 9–10(–11) × 6.5–7(–8) × 5.5–6.5 µm, subrhomboid or obscurely subovoid in face-view, subellipsoid in side-view, thick-walled, wall 1–1.5 µm thick, yellowish brown, with a truncate germ pore at the apex and a short acute apiculus at the base. Basidia 25–36 × 7–8(–9) µm, 4-spored, hyaline, ventricose-subcylindric or subclaviform, with a middle constriction, sterigmata up to 12 µm long. Pleurocystidia polymorphous, arising from the subhymenium, of two types: (A) 20–37(–44) × 7–9.5 µm, hyaline, ventricose-subcylindric, short rostrate or with a long narrow and cylindric neck, sometimes branched; (B) 22–29 × 10–15 µm, as pseudocystidia, hyaline or yellowish pale, subglobose, subfusiform or ovoid, thin-walled. Cheilocystidia polymorphous, of two types: (A) 16–22(–27) × 6.5–9.5 µm, fusiform, ventricose, rostrate, regular or irregularly, apex short or long, sometimes lobulate; (B) 18–24 × 9.5–13 µm, rare, as pseudocystidia, grayish, arising from the hymenophoral trama. Subhymenium thick, hyaline, subcellular, globose elements 5.5–13 (–20) µm wide. hymenophoral Trama regular, with hyaline to yellowish brown hyphae, 2–16 µm wide. Pileipellis subgelatinous, with hyaline hyphae, 2–4 µm wide. Context with hyaline to yellowish hyphae, 3.5–34 µm wide, thin-walled. Clamp connections present.

Habit, habitat and distribution — Gregarious, on soil with rotting dung, in an open grassland, at 300 m elevation. Known only from the type locality.

Discussion. *Psilocybe thaiduplicatocystidiata* with its small, subrhomboid, thick-walled spores is a special member of the sect. *Cordisporae* as it has two types of both pleurocystidia and cheilocystidia, one as pseudocystidia, a feature not previously observed on any species of sect. *Cordisporae* (Guzmán 1983, 1995). This species may also possess a pseudorhiza, but this was lost during picking. The basidiome is similar to *P. caerulescens* Murrill, but that species lacks pleurocystidia, the cheilocystidia are not polymorphous and its basidiospores are (6–)6.5–8(–8.5) µm long. *P. thaiduplicatocystidiata* is also similar to *P. wrightii* Guzmán, but the latter has simple pleurocystidia and cheilocystidia, and also smaller spores. These two similar species are only known from the neotropics.

Psilocybe thaizapoteca Guzmán, Karunarathna & Ram.-Guill., **sp. nov.**

MycoBank MB 561578 Figures 16–20

Differs from *Psilocybe angustipleurocystidiata* in a thick subgelatinous pilleipellis and presence of branched, lobed pleurocystidia.

Type: Thailand, Chiang Mai Prov., close to Huai Nam Dang National Park (19°16′N 98°16′E), elevation 1500 m, rainforest dominated by *Pinus kesiya*, July 12, 2010, Guzmán 38342 (**holotype** MFLU-10-0797, **isotype** XAL).

Etymology: The epithet refers to Thailand and similarity of the fungus to the *P. zapotecorum*-group.

Pileus (20–)30–50 mm diam., conic-umbonate to campanulate, finally convex to plano-convex, sometimes irregularly lobulate, glabrous overall, smooth, lubricous to soon dry, cuticle not separable, sub-hygrophanous, brownish red with chocolate tints, at the margin without veil remnants. Lamellae adnexed or short sinuate, brownish chocolate, edges whitish. Stipe 70–120 × 4–8 mm, uniform but narrow toward the base, hollow, sub-fleshy to fibrous, whitish above, brownish red or brownish purple to whitish gray or dark vinaceous at the base. Pseudorhiza as a long irregular whitish cordon. Veil poorly developed as fibrillar remnants. Context white to whitish, fleshy, bluing to blackish. Odor and taste slightly farinaceous at first, but the taste also a little pungent in fresh specimens. Spore print unknown.

Basidiospores 6–6.5(–7) × (3–)3.5–4(–4.5) × 3–3.5 µm, subellipsoid or obscurely subrhomboid in face-view, subellipsoid on side-view, thin-walled, wall 0.5–0.8 µm thick, pale yellowish brown, with a truncate germ pore at the apex and a short acute apiculus at the base. Basidia 19–25 × (4.5–)5–5.5(–6) µm, 4-spored, hyaline, ventricose, subcylindric, or claviform with a middle constriction. Pleurocystidia 13–20(–30) × (3–)4–6(–7.5) µm, common, hyaline, subventricose or subcylindric regular or irregularly but acute mucronate, frequently irregularly branched or lobed. Apparently there are two kind of pleurocystidia, smaller and bigger, but these latter are very rare. Pseudocystidia absent. Cheilocystidia 15–22(–25) × 4–7(–8) µm, hyaline, subventricose, somewhat claviform, all of them mucronate, regular or irregularly, also irregularly lobulate or subbranched. Subhymenium subcellular, hyaline, with thin-walled, somewhat incrusted hyphae. hymenophoral Trama regular, with 3–30 µm wide, hyaline to yellowish or pale brownish hyphae, some of them swollen. Pileipellis as thin layer, not gelatinous, with hyaline hyphae, 1–2(–5) µm wide, without pileocystidia. Context like the hymenophoral trama hyphae. Clamp connections present.

Habit, habitat and distribution — Gregarious, on muddy soil with few herbs, mosses and grasses, in a tropical-subtropical vegetation, with Dipterocarpaceae trees and some *Pinus*. Known only from the type locality.

Discussion. Its thin-walled, subellipsoid spores place *P. thaizapoteca* in sect. *Zapotecorum* Guzmán, reported the first time from Thailand. *Psilocybe angustipleurocystidiata* Guzmán (known only from Colombia and Mexico), which also lacks pseudocystidia, differs in its thick (10–15(–20) µm) subgelatinous pileipellis and pleurocystidia that are neither branched nor lobed. *Psilocybe aucklandiae* Guzmán et al. (known only from New Zealand) is differentiated by the subgelatinous pileipellis and unbranched cheilocystidia and pleurocystidia. *Psilocybe kumaenorum* R. Heim (known only from Papua New Guinea) is also similar to *P. thaizapoteca* but is distinguished by small basidiomata (pileus 5–7 mm diam, stipe 15–30 × 1–2 mm) and non-lobed cheilocystidia (Heim 1966).

Key to species of *Psilocybe* s.l. reported from Thailand

(bold = new species described in the present paper)

1a. Non-bluing species (excluded from *Psilocybe* s.s.) ..... *Deconica deconicoides*
1b. Bluing species 2

2a. Spores thin-walled, rhomboid or subellipsoid in face-view. On muddy soil ..... ***P. thaizapoteca***
2b. Spores thick-walled, subrhomboid or subhexagonal in face-view. Not on muddy soil 3

3a. Annulus present 4
3b. Annulus absent 7

4a. Spores (12–)13–15(–17) µm long, subhexagonal in face-view. Chrysocystidia absent ..... *P. cubensis*
4b. Spores smaller, up to 12 µm long. Chrysocystidia present or absent. 5

5a. Chrysocystidia absent. Spores 9–12 µm long. Growing on litter ..... ***P. thaiaerugineomaculans***
5b. Chrysocystidia present 6

6a. Spores 7–8 µm long. On elephant dung ..... *P. magnispora*
6b. Spores (4.5–)5–6(–6.5) µm long. On rotten wood ..... *P. thailandensis*

7a. Pleurocystidia and cheilocystidia of two types. Growing on soil ..... ***P. thaiduplicatocystidiata***
7b. Pleurocystidia and cheilocystidia of one type. On grassy soil 8

8a. Spores 10–13 µm long ..... *P. samuiensis*
8b. Spores (6.5–)7–8(–9) µm long ..... ***P. thaicordispora***

Final considerations

It is interesting that four new species were found during such a short excursion time (five days) in Thailand, while none of the five species previously reported for the country were found. We suggest this demonstrates the complexity of mushroom fructification and at same time the richness of the mycota in the tropics. We confirmed that species of *Psilocybe* s.s. sects. *Cordisporae*, *Mexicanae, Stuntzae,* and *Zapotecorum* are tropical or subtropical. We also observed that bluing species have a greatly varied habitat, for example, litter, muddy soil, rotten wood or dung. Although the odor and taste of basidiomata are generally farinaceous for all bluing *Psilocybe* species, for Thai species odor and taste are either not distinctive or acidulous to only very slightly farinaceous, with the taste of dried material in all four new species (as well of fresh basidiomata in *P. thaizapoteca*) becoming strongly pungent after some minutes.

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